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Nutritional Status of Population in South Konkan Region of Maharashtra

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Abstract

The main objective of this paper is to evaluate the nutritional status of population, tehsilwise, based on chemical composition of the food consumed by people in the region. This is supplemented by analysing the gender and rural-urban differential of nutritional deficiency from the RDA. Wide range of variations exists among the tehsils of the study region. Two third people depend on cereals for majority nutrients. Total nutritional deficiency occurs more in Devgad, Ratnagiri, Sangameshwar, Chiplun, Khed and Dapoli tehsils. The population above 6 years is affected by high proportion of energy, carbohydrates, carotene, riboflavin, ascorbic acid, calcium, phosphorous, folic acid and iron deficiencies in totality. Females record more deficiencies of energy, carotene, riboflavin, vitamin C and calcium; it is slightly greater than that of the males. The proportion of urban nutritional deficiency is bigger than the rural areas.

Introduction

Health and nutrition are the most important contributory factors for human resource development in any country. Among the Indian population, about 40 per cent in the rural and 30 per cent in the urban areas are estimated to be below the poverty line. Per capita calorie intake is declining, as is the intake of many nutrients; fats are the only major nutrients groups whose per capita consumption is unambiguously increasing. Today, more than three quarters of the population live in households whose per capita caloric consumption is less than 2100 in urban areas and 2400 in rural areas-numbers that are often called as "minimum requirements" in India.

The status of nutrition in Maharashtra is not encouraging. As much as 57.4 per cent of households in rural areas and 54.8 per cent in the urban consume less than the standard calories per day. Only about a quarter of all households in the rural and 28 per cent in the urban areas belong to an average calorie intake ranging from 90 per cent to 110 per cent. A low level of food intake impacts the nutritional status of women and children. Nearly half the ever-married women between 15 and 49 years suffer from anaemia, which is marginally higher in the rural areas at 51.2 per cent than in the urban areas, where it is 44.8 per cent. The proportion of women in the clutches of mild, moderate and severe anaemia is 31.5 per cent, 14.1 per cent and 2.9 per cent respectively. Of the children under three years, 76 per cent were also suffering from anaemia, the levels being comparatively higher in rural areas. The situation is not different in the Ratnagiri and Sindhudurg districts of Maharashtra. Therefore, here an attempt has been made to gain knowledge of the nutritional status of population.

The present study endeavors to examine variations in the nutritional status of population based on food consumed. It is normally classified into different categories on the basis of 1) Origin - including subtypes like foods of animal and vegetable origin; 2) Chemical composition – made up of proteins, fats, carbohydrate, vitamins and minerals; 3) by predominant function - its sub division include body building food, energy giving food and protective food; and 4) food classified by nutritive value - the sub types of which are cereals and millets, pulses (legumes), vegetables, fruits, nuts and oil seeds, animal food, fats & oils, sugar and jaggery, condiments and spices and others. All the above mentioned food consumed by people help access the nutritional status of population. With this background an attempt has been made here to analyse the nutritional status of population in Maharashtra's South Konkan region.

Objectives

The chief objectives of the present study are to:

i) examine the nutrients available to the population from different food groups.

ii) analyse the tehsilwise food consumption by nutritive values.

iii) evaluate the gender differential and rural-urban differential in food consumption of various nutrients in the study region.

Data Base and Methodology

The present study is based on primary and secondary sources of data. Tehsils have been chosen as spatial unit of analysis. Primary data has been collected from intensive household surveys conducted during April 2007 and 2008, with the help of a well-framed food consumption questionnaire, which gave information about the nutrient intake. The nutrient content of each food eaten was calculated from food table as: Portion size (g) X Frequency x Nutrient content per gand summed for all foods eaten by each individual during the study period. This data was then converted into different nutrients on the basis of table supplied by the National Institute of Nutrition and Indian Council of Medical Research (Gopalan & others, 1989). Qualitative and quantitative aspects of nutritional intake have been analyzed in this paper. The qualitative food measures the values of different nutrients in foodstuff available in the diet. The quantitative food, i.e. the energy content, has been measured in terms of proximate principle values of essential nutrients. The results of the analysis are presented in tables and diagrams generated by using various techniques and methods of analysis. The level of nutrients intake are give in (IU) International Units.

In the present study, the food consumed by the people of the region is divided into nine food groups: (i) cereals and millets-including crops like rice, *ragi, varagu, panivaragu,* maize etc. (ii) Pulses and legumes-consisting of foodstuff like green gram, pigeon pea, black gram, horse gram, cow pea, bengal gram etc; (iii) Sugar and glucose-honey, sugarcane and cane jaggery lie in this category; (iv) Vegetables–have subgroups: a) leafy vegetables, including fenugreek leaves, coriander leaves, cauliflower green etc, b) roots and tubers, viz., carrot, onion, potato, sweet potato, radish, beet root etc; c) other vegetables-bitter gourd, brinjal, cluster beans, cucumber, cluster beans, etc; (iii) Sugar and glucose-honey, sugarcane

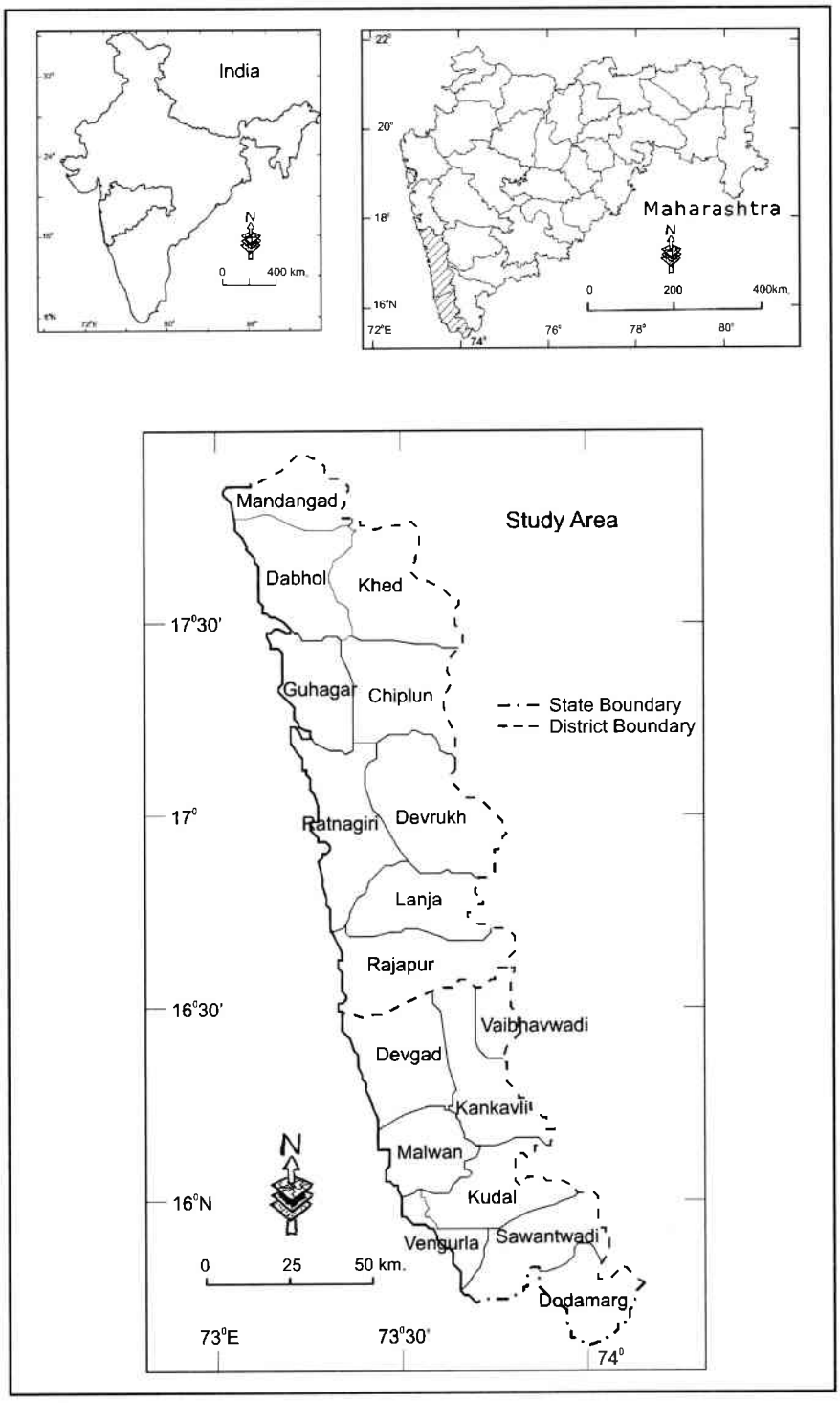
India
Maharashtra
0 400 km.
0 200 400km.
Study Area
Mandangad
Dabhol
Khed
Guhagar
Chiplun
Ratnagiri
Devrukh
Lanja
Rajapur
Vaibhavwadi
Devgad
Kankavli
Malwan
Kudal
Vengurla
Sawantwadi
Dodamarg
State Boundary
District Boundary
17°30'
17°
16°30'
16°N
73°E
73°30'
74°
0 25 50 km.

Fig. 1:

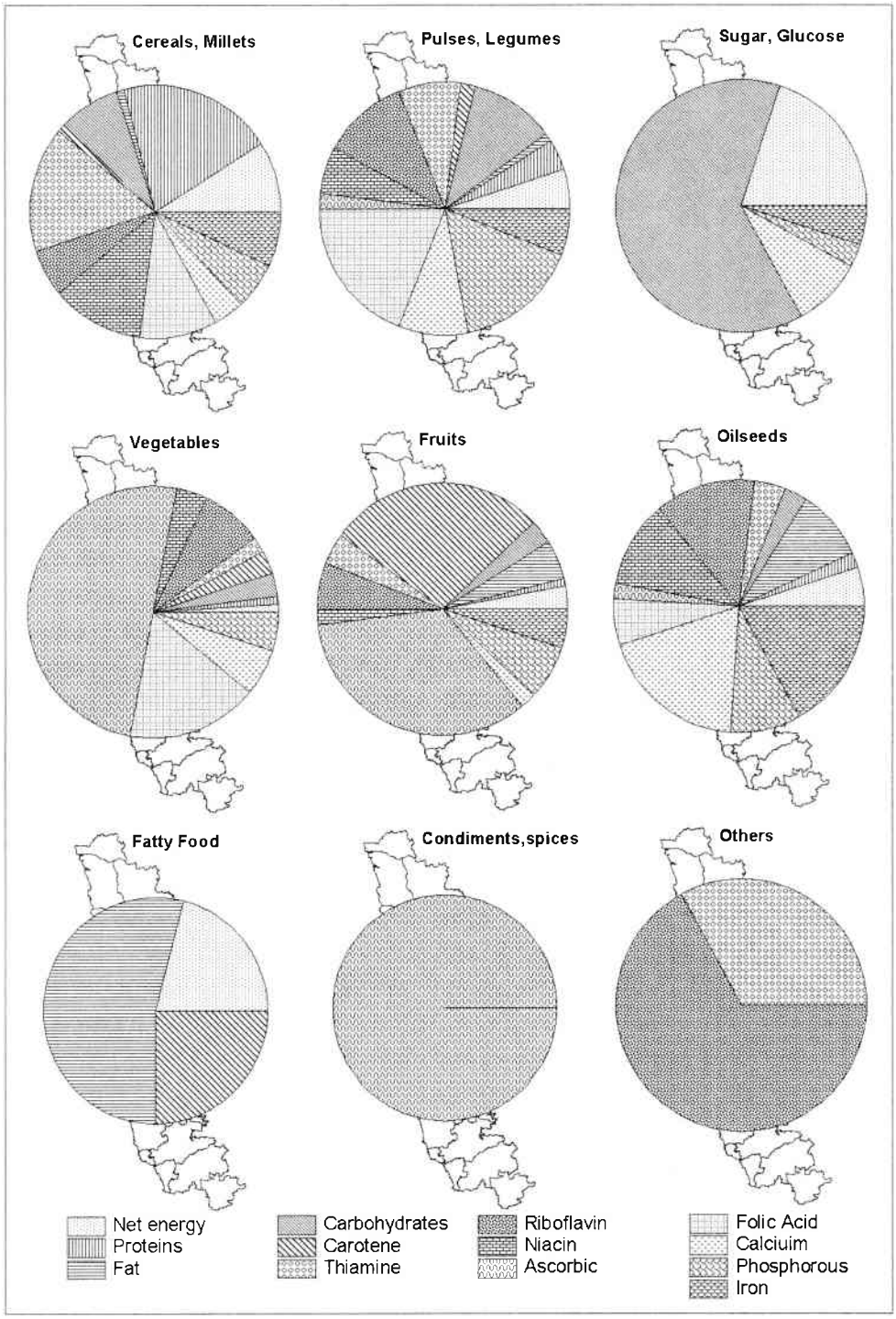
Cereals, Millets
Pulses, Legumes
Sugar, Glucose
Vegetables
Fruits
Oilseeds
Fatty Food
Condiments,spices
Others
Net energy
Proteins
Fat
Carbohydrates
Carotene
Thiamine
Riboflavin
Niacin
Ascorbic
Folic Acid
Calciuim
Phosphorous
Iron

Fig. 2:

and cane jaggery lie in this category; (iv) Vegetables–have subgroups: a) leafy vegetables, including fenugreek leaves, coriander leaves, cauliflower green etc, b) roots and tubers, viz., carrot, onion, potato, sweet potato, radish, beet root etc; c) other vegetables-bitter gourd, brinjal, cluster beans, cucumber, cluster beans, etc; (iii) Sugar and glucose-honey, sugarcane and cane jaggery lie in this category; (iv) Vegetables–have subgroups: a) leafy vegetables, including fenugreek leaves, coriander leaves, cauliflower green etc, b) roots and tubers, viz., carrot, onion, potato, sweet potato, radish, beet root etc; c) other vegetables-bitter gourd, brinjal, cluster beans, cucumber, cluster beans, *knoll-khol* etc.; (v) Fruits-Mango, banana, jackfruit, guava etc; (vi) Oilseeds – gingelly seeds, groundnut, niger seeds, etc; (vii) Fatty food–butter, ghee, buttermilk, cheese, milk etc; (viii) Condiments and spices-chilli, clove, ginger, garlic, tamarind, turmeric etc.; (ix) Others – all other remaining foodstuff is categorized as others.

Chemical composition of food consumed by human beings is sub-divided into (a) Fat soluble food: made up of vitamin A, D, E, and K; (ii) Water soluble: (a) Vitamins ie., A, B, C; (b) Major minerals calcium, phosphorous, sodium; and (c) Trace elements: iron, chromium, selenium, fluorine etc.

Study Area

Ratnagiri and Sindhudurg districts of Maharashtra State lies between 15^0 36' to 18^0 4' north latitudes and 73^0 2' to 74^0 36' east longitudes **(Fig. 1)**. It extends over an area of 13,415 sq. km which is about 4.2 per cent of the State's geographical area. Its shape being elongated, no point is more than 100 kms away from the sea. The east-west extension varies from 40 to 90 km, averaging 66.34 kms. Administratively, the region consists of 15 sub-divisions.

According to 2001 census, the population of this region is about 25, 65,602, i.e., about 2.64 percent of the state's total population, of which 89.30 per cent is rural. The study region has 195 persons per sq. kms which is less than the states average; sex ratio is 1123 females per 1000 males, higher than that of the State. The average people above 50 years age is 3.68 percent; while only 2.50 per cent of population is upto 50 years old; and 13.37 percent in the age group of 0 to 6 years. The literacy in the region is 76.5 per cent.

Food-Group Based Nutrients Availability

Two thirds of the study region's population depends on cereal-based or tuber based diets for the nutrients, the other consumes significant amounts of animal food products. As shown in Fig.2, cereals provide about 36.3 per cent of the net energy to the population, followed by fatty food (22.1%); oil seeds (14.6 %), sugar and glucose (9.9 %), pulses and legumes (9.1) , fruits (7.7 %), vegetables (0.3 %) in descending order. Condiments & spices supply negligible energy due to its less consumption.

Tehsilwise, total net energy available from cereals is same (29803 IU) in all the tehsils of Ratnagiri along with Vaibhavwadi, and Dodamarg tehsils of Sindhudurg district This is because rice, *panivaragu* and ragi crops are commonly found in the tehsils. Devgad, Kankavli, Malwan, Vengurla & Kudal also cultivate maize in addition to the three main cereal crops that provides

extra energy to population in these tehsils. The same pattern is found in the tehsils in connection with the remaining nutrients. The nutrients supplied by pulses to the population is same i.e., 7147 IU net energy; 1921 IU proteins; 362 IU fat; 4864 IU carbohydrates; 15867 IU carotene; 92 IU thiamine; 41 IU riboflavin; 407 IU niacin; 113 IU vitamin C; 10995 IU folic acid; 25700 IU calcium; 69033 IU phosphorous; 1052 IU iron respectively in all tehsils of Ratnagiri district and newly created Vaibhavwadi and Dodamarg tehsils of Sindhudurg district. These nutrients are available from the six varieties of pulses & legumes cultivated. The availability of nutrients from pulses is less in Rajapur, Vaibhavwadi, Kankavli, Malwan, Vengurla, Sawantwadi and Dodamarg. The consumption pattern of sugar, glucose and fatty food is same throughout the study region providing 7744 and 18002 IU energy; 22 and 0 IU proteins; 6 and 18002 IU fat; 7715 and 0 IU carbohydrates; 0 and 91500 IU carotene; 0 & 0 IU thiamine, riboflavin, niacin, ascorbic acid and folic acid; 6467 and 0 IU calcium; 3800 and 0 IU phosphorus; 233 and 0 IU iron respectively. Fruits provide almost the same i.e., 7042 IU of energy; 916 IU proteins; 4470 IU fat; 1656 IU of carbohydrates; 280300 IU of carotene; 71 IU, 28 IU, 210 IU of thiamine, riboflavin and niacin; 1600 vitamin C, 6400 IU, 46600 IU, 711 IU of calcium, phosphorous and iron respectively in all tehsils of Ratnagiri district. The tehsils in Sindhudurg have variations in available nutrients from fruits. Different oilseeds cultivated and used also lead to variations in the nutrients. The proportion of nutrients available from the last category i.e., condiments and spices is very less as its consumption is comparatively less. It is because spices and condiments are added in order to increase flavor and taste to the food, acting as taste making elements. Many other food categories all provide nutrients to the population in the study region.

About 63.4% of Vitamin-A is obtained from fruits. Fatty food provides the next largest per cent of vitamin A which is about 26.3. Pulses and cereals supply about 4.6 and 4 % Vitamin A respectively, all the remaining groups provide less than 1 per cent individually. Most of the thiamin is supplied by cereals (65.3), followed by pulses, oilseeds and fruits in descending order, the proportion being 14.3, 10.6 and 9.2 per cent respectively in decreasing order. Largest proportion of riboflavin (36.7%) is found in oilseeds, followed by cereals, pulses and fruits in decreasing order. Vitamin B_2 is absent in sugar and glucose, oilseeds and fatty food. Cereals contain most of the niacin (51.9 %); closely followed by oilseeds and pulses (31.5, 10.5 %). Fruits and vegetables contain only 5.1 and 1 per cent of Vitamin B_3. Folic acid is supplied by cereals, pulses oilseeds and vegetables only, its proportion being 43.1, 36.4, 16.1 and 4.5 respectively. From the minerals, oilseeds have the largest (55.8%) per cent of calcium, followed by pulses and cereals. All remaining food groups have less than 5 per cent calcium. Pulses, oilseeds, cereals and fruits have larger proportion of phosphorous; while oilseeds, cereals, pulses and fruits provide sufficient iron to the people in decreasing order in the study region.

Food Consumption by Nutritive Values

Energy: The diet of the population in the study area is deficient in quantity. The average intake of energy among the population of the study region is 7113 IU, which is 48 percent lower than the internationally recommended

dietary requirement (RDR) of 13500 per capita per day. It is an indication of under nutrition and malnutrition in the study region. Highest energy intake is found in the Kankavali tehsil, intake being around 17500, followed by Mandangad (13400), Sawantwadi (11133) and Kudal (11100). The high in Kankavali can be attributed to the cultivation and consumption of different food groups viz. cereals, millets, pulses, legumes, oilseeds, condiments and spices. On the contrary, cultivation of very few crops in Devgad tehsil has reduced the energy intake to a mere 586 I.U, which is the lowest in the study region. Main source of energy in the area is mainly cereals, millets, oilseeds, legumes and pulses in totality.

Proteins: The average intake of proteins among the population is 1948 IU, which amounts to about 93.2 per cent higher than the recommended requirement (10081U). The pulses and legumes are the main source of proteins in the study region. The cultivation and production of distinct pulses in all the tehsils have augmented its intake & consumption among the population. Protein deficiency exists among the population in Devgad, Ratnagiri & Chiplun tehsils, ranging from 84 to 7 per cent. Devgad tehsil is the largest producer of mangoes. Most of the people are engaged in producing & selling mangoes to other countries thus reducing the local consumption of proteins due to lack of knowledge regarding the nutritive value of mangoes. Ratnagiri and Chiplun have seen the influence of western eating habits being located along the coast. This changed the food habits, customs, beliefs, traditions and attitudes of the people. They increased consumption of bakery products thus reducing the intake of proteins in these two tehsils. Rest of the tehsils has sufficiently more protein consumption. Kankavli tehsil of Sindhudurg district records the highest protein intake. The interior located tehsil Kankavli has greater intake of wheat, ragi and panivaragu which has larger protein content among the cultivated cereals.

Fats: The average intake of fats in the study region is 29.7 per cent higher than the recommended requirement of 2268 IU in ten tehsils. The largest consumption is recorded in Kankavli tehsil of Sindhudurg district, followed by the northern Mandangad and the southern Sawantwadi tehsil. Large variety of oilseeds having high fat content are cultivated in the southern Sawantwadi tehsil, oil is locally available & is consumed by the population. Kankavali specializes in production of groundnut & coconut, having highest fat content. On the contrary, people in Devgad, Ratnagiri and Chiplun have high proportion of fat deficiency, ranging from 89 to 10 percent.

Carbohydrates: The average intake of carbohydrates among the population in the study region is far lower (78.1%) than the RDR of 10140 I.U. Deficiency of carbohydrates is highest in Devgad, closely followed by Ratnagiri and Chiplun tehsils. This is because the consumption of vegetables and roots, which is the main source of carbohydrates, is low in these three tehsils.

Vitamins: Vitamins are a class of organic compounds categorized as essential nutrients. They are required by the body in very small amounts. They fall in the category of micronutrients. Vitamins enable the body to use other nutrients. The body

is generally unable to synthesize them and so must be provided by food (Park, 2009). The average daily intake of vitamins in the region is approximately 25316 (carotene), 56 (thiamine), 20 (riboflavin), 384 (niacin), 775 (ascorbic acid), 3139 (folic acid) IU.

Vitamin A (Carotene): The daily intake of Vitamin A is alarmingly deficient in all the tehsil, the deficiency percentage ranging from 97 (Devgad) to 24.7 in Kankavli. This is because consumption of all categories of vegetables, fruits and milk is very less. Among vegetables, potatoes and onion are more popular.

Thiamine (B_1): The average intake of thiamine in the study region amounts to 56 IU. Only seven tehsils have satisfactory thiamine consumption, including northern most Mandangad tehsil & Lanja of Ratnagiri district; and Kankavli, Kudal, Sawantwadi, Vaibhavwadi and Vengurla tehsils of Sindhudurg district. The high in Sindhudurg district is mostly due to the consumption of cereals & some vegetables. The deficiency of vitamin B_1 in the remaining tehsils is the result of less consumption of vegetable, milk etc. due to nonavailability of vegetables mainly a result of poor economic condition.

Riboflavin (B_2): Riboflavin (vitamin B_2) deficiency results in the condition of hypo- or ariboflavinosis, with sore throat; hyperaemia; oedema of the pharyngeal and oral mucous membranes; cheilosis; angular stomatitis; glossitis; seborrheic dermatitis; and normochromic, normocytic anaemia associated with pure red cell cytoplasia of the bone marrow (McCormick, 1997; 1996). The intake of riboflavin is very less in all the tehsils of the region, nutritional deficiency ranging from 96.9 per cent (Devgad tehsil) to 32.4 per cent in Mandangad. This is because rice is the staple food of the population and is consumed in large amounts, but rice is a poor source of riboflavin. Also less consumption of green leafy vegetables and milk has increased the deficiency of riboflavin among all tehsils of the study area.

Niacin (B_3): Niacin or nicotinic acid is essential for the metabolism of carbohydrates, fats and proteins, also essential for the normal functioning of the skin, intestinal and nervous systems. The average intake of niacin amounts to 384 IU in the entire south Konkan region. Niacin deficiency occurs in Devgad, Ratnagiri, Chiplun, Sangameshwar, Rajapur and Dapoli tehsils. This is due to less consumption of legumes, liver, kidney and groundnut, which are the main rich sources of niacin, due to low purchasing power of the population and improper food habits.

Vitamin C or Ascorbic Acid: It is a water soluble vitamin, and the most sensitive of all vitamins to heat. It is a six-carbon lactone which is synthesized from glucose by many animals. Vitamin C is synthesized in the liver in some mammals and in the kidney in birds and reptiles. However, several species—including humans, non-human primates, guinea pigs, Indian fruit bats, and Nepalese red-vented bulbuls—are unable to synthesize vitamin C. When there is insufficient vitamin C in the diet, humans suffer from the potentially lethal deficiency disease scurvy (Stewart, Guthrie eds., 1953). Vitamin C plays an important role in tissue oxidation. It facilitates the absorption of iron from vegetable food. It is required for

healthy bones & teeth. Excluding Kankavli and Sawantwadi all the tehsils lack vitamin C and the region averages nearly 60 % deficiency of ascorbic acid from the RDR daily intake. This is because vitamin C is present in large numbers in fresh fruits and green leafy vegetables that are hardly consumed by the people due to lack of knowledge regarding its nutritive value, ignorance, poverty and unhealthy food habits.

Folic acid: Folic acid is haemopoietic vitamin essential for multiplication and motivation of red cells (NIN, 2005). The study region averages 21 per cent deficiency of folic acid from the recommended daily intake. The intake of folic acid is greater than the standard requirement in Sawantwadi, Mandangad, Kankavali and Kudal tehsils only. The high in Mandangad can be attributed to the large scale consumption of cow pea and bengal gram - pulses containing higher proportion of folic acid. Inhabitants of the southern tehsils viz., Sawantwadi and Kudal frequently consume lady's finger and cluster beans which has increased the proportion of folic acid among the population in these two tehsils. Black gram and bengal gram among the pulses are the most favorite foodstuffs, frequently consumed by the Kankavli tehsil residents. Therefore the level of folic acid is sufficient. The rest of the tehsils have greater folic acid deficiency, highest deficiency of 93 percent recorded in Devgad tehsil. This high percent of folic acid deficiency can be attributed to the sparse consumption of fruits and vegetables caused by likes and dislikes in the selection of food, cooking practices, food scarcity besides other economic, social and cultural factors.

Calcium: Calcium is a divalent cation with an atomic weight of 40. In the elementary composition of the human body, it ranks fifth after oxygen, carbon, hydrogen, and nitrogen, and it makes up 1.9% of the body by weight (Nordin, 1976). Ionized calcium in the plasma performs many vital functions like formation of bones and teeth, coagulation of blood, contraction of the muscles, cardiac action, milk production and others. The daily intake of calcium is 56.5 per cent lower than the recommended daily intake level among the population in the region. The proportion of calcium deficiency ranges from (high) 96 percent in Devgad tehsil to (low) 6.3 per cent in Mandangad tehsil. This is because the population is unable to consume milk, green leafy vegetables and fruits which contain larger proportion of calcium.

Phosphorous: The average intake of phosphorous in the study region is 23586, which is 34.5 per cent lower than the recommended intake level of 36000 IU. In all, only four tehsils- Kankavli, Mandangad, Kudal and Sawantwadi have sufficient intake of phosphorous among the people. The rest of the tehsils have recorded deficiency of phosphorous ranging from 94.1 per cent (high) in Devgad tehsil to 30 in Lanja & Vengurla tehsils. The high proportion of phosphorous deficiency in 13 tehsils can be attributed to the lack of information about the importance of phosphorous consumption in human life cycle that has led to ignorance of its consumption. Population in Kankavli, Mandangad, Kudal & Sawantwadi is far above the recommended level. Vegetables like lady's finger, brinjal, onion containing high phosphorous is cultivated & consumed on a large scale by people in Kudal & Sawantwadi tehsil from where it is also

transported to Kankavli. Hence these three tehsils are safer in connection with sufficient phosphorous intake in the daily diet. On the contrary, the people residing in the northern most Mandangad taluka of Ratnagiri district acquire reasonable portion of phosphorous from cereals & pulses that are locally available.

Iron: Iron has several vital functions in the body. It serves as a carrier of oxygen to the tissues from the lungs by red blood cell haemoglobin, as a transport medium for electrons within cells, and as an integrated part of important enzyme systems in various tissues. The physiology of iron has been extensively reviewed (Bothwell, 1979; Hallberg, 1982; Dallman, 1986; Brock, Halliday and Powell, 1994; Kühn, 1996; Mascotti, Rup and Thach, 1995). The average iron intake falls short by 22.6 per cent in the entire region. The lower intake of green leafy vegetables is mainly responsible for lower iron intake in the daily diet of population in the study region. Disparities in the proportion of iron deficiency exist from a high of 93 percent (Devgad tehsil) to a low of 8.4 per cent in Lanja tehsil. On the contrary, Mandangad, Sawantwadi, Kudal and Kankavli tehsils have sufficiently reasonable intake of iron, greater than the IU standard intake levels.

Gender Differentials

Overall inferior diet of the females is recorded in comparison to the diet of the males in the study region. As a family custom and tradition, food is first consumed by children, followed by males first and then females. As a result, the females have to eat the remaining insufficient food. Deficiency of specific nutrients have been recorded among both the males & females, but overall deficiency is higher among the females than the males in the region.

The energy deficiency is higher among the females (-3.5 percent) then the males (10.5%). The deficiency of riboflavin, vitamin C & calcium is higher among females as compared to the males. The deficiency of riboflavin is 14.6% higher among females (-37.2%) than males (-22.7%). The deficiency of Vitamin C is 11.4 % higher, and calcium deficiency is 13.5 % higher among the females than males. The deficiency of Vitamin A is similar among the males & females while deficiency of protein, fat, carbohydrates, thiamin, Niacin, folic acid, phosphorous & iron is higher among the males than females in the study region. Increase in the consumption of fast food and alcohol as a symbol of high status in the society and office among the males recently has reduced the intake of the eight nutrients.

Tehsil wise, the energy deficiency of females is less in all tehsils as compared to the male energy deficiency (Fig. 3). In relation to protein consumption, tehsils namely Chiplun, Devgad, Vaibhavwadi, Malwan, Vengurla, Kudal, and Dodamarg have more protein deficiency among the females than the males. The percentages of fat deficiency among the females outnumber the males' deficiency in Devgad tehsil only. The consumption of carbohydrates among the females in all tehsils is less than that of males' deficiency. Thiamine deficiency of females in Chiplun, Guhagar, Sangameshwar, Lanja, Rajapur, Vaibhavwadi, Kankavli, Malwan, Vengurla, Kudal, Sawantwadi & Dodamarg tehsils is less than that of male's thiamine deficiency. A somewhat similar condition in deficiency of niacin is recorded among

South Konkan Region : Male Female Nutritional Deficiency - 2009

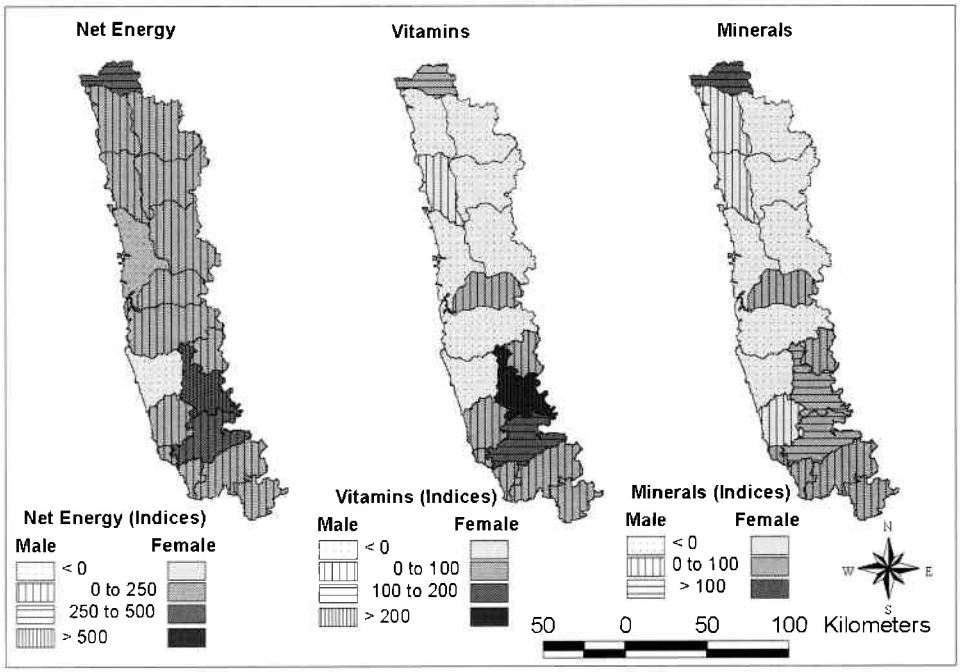

Fig. 3

South Konkan Region : Rural Nutritional Deficiency - 2009

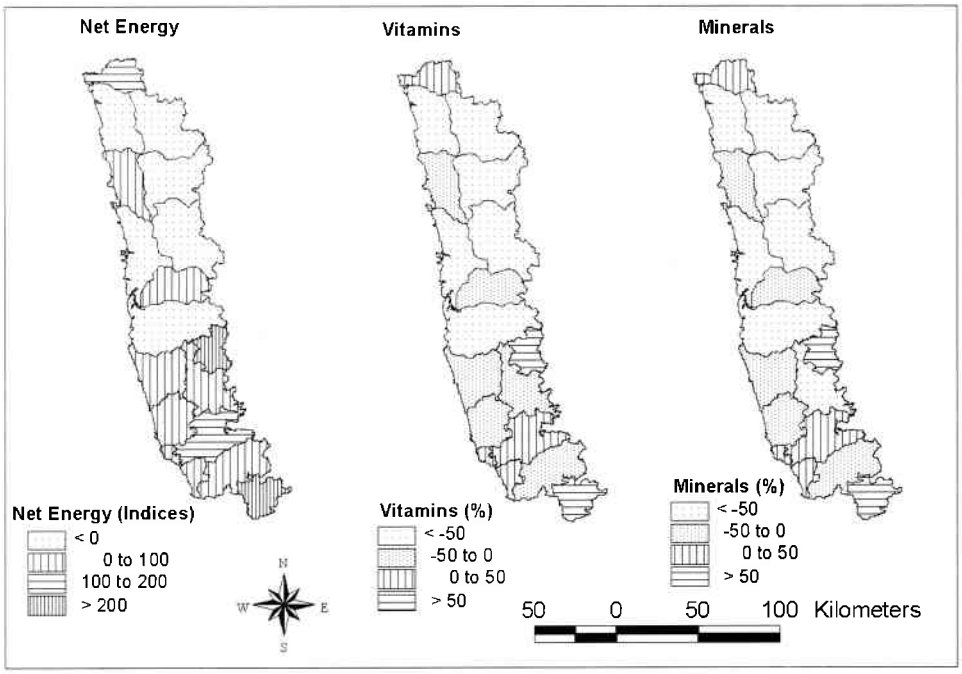

Fig. 4:

the population in the different tehsils of the region. High percent of vitamin C deficiency among the males is noted in Kankavli, Malwan, Vengurla, Kudal and Sawantwadi than females in the same tehsils. Low percent deficiency of folic acid among females is recorded in Mandangad, Khed, Guhagar, Sangameshwar, Rajapur, Vaibhavwadi, Kankavali, Malwan, Vengurla, Kudal, Sawantwadi & Dodamarg tehsils than males.

Rural-Urban Differential

The deficiency of all the nutrients among the people has been recorded in the urban centres of the study region. The average deficiency is more than 95 per cent of all the nutrients excluding fat, whose deficiency is just 0.4 per cent (Fig. 4). This high proportion deficiency in urban areas can be attributed to the change in food habits of urban population. The change occurred due to the influence of western culture and modernization in urban lifestyle that has been introduced by media and increase in communication with the highly industrialized and urbanized centres in and around the study region. The consumption of beverages (soft drinks), bakery products and fast food has largely increased, resulting in the deficiency of the essential nutrients. This can also be seen from the less per cent of fat deficiency (fast food and bakery products have more fat content and less proteins, carotene, thiamine, vitamin C, calcium, iron and folic acid).

Most of the rural areas of the tehsils have moderate to low deficiency of energy, carotene, niacin, ascorbic acid, calcium, and phosphorous. The deficiency of all these nutrients in the rural areas can be collectively attributed to the absence of green vegetables, milk and citrus fruits in the diet. The rest of the nutrients have a satisfactory consumption level among the rural population in most of the tehsils of Ratnagiri and Sindhudurg districts of Maharashtra state.

Conclusion

It may be concluded from the preceding analysis that spatial disparities exist in the patterns of food consumption based on food groups. Two thirds of the study regions population depends on cereal based diet. Cereals like rice, panivaragu and ragi provide about 36.3 per cent of the net energy to the population. Butter, ghee, buttermilk and curd falling under the category of fatty food, supply about 22 % of the total energy. The energy supplied by the remaining food groups is very less or negligible.

Tehsilwise, total nutritional deficiency occurs more in Devgad, Ratnagiri, Sangameshwar, Chiplun, Khed and Dapoli tehsils, the deficiency percent averages to more than 40 IU from the RDA. In these tehsils, the nutrients available to population from food groups are also very less, i.e. only cereals provide majority of the nutrient variations. Comparative male and female deficiencies of nutrients are more in these tehsils along with deficiencies of population in the rural areas. Cultivation of crops and food availability has its impact on the proportion of nutrients among the people.

The population above 6 years is affected by high proportion deficiencies of energy, carbohydrates, carotene, riboflavin, ascorbic acid, calcium, phosphorous folic acid and iron in totality. These deficiencies generates possibilities of extremely dry skin, night blindness, eye irritation, inflammation and

breakdown of skin cells, blood vessels and teeth; anaemia and diarrhoea; convulsions, rickets, osteoporosis, loss of calcium and weakness. Prolonged deficiencies of the above mentioned nutrients will cause severe problems of nutritional deficiencies.

The deficiencies of carotene, riboflavin, vitamin C and calcium is largely recorded among the males the intake of which is 74, 23, 23, and 10 percent lower respectively than recommended requirement. In addition to these, females also have deficiency of energy that is 3% lower than the RDA. The proportion of nutrients deficiency among the females is slightly greater than that of the males.

Nutritional deficiency has been recorded both in rural and urban centers of the study region, but the proportion of urban nutritional deficiency is greater than the rural areas. The rural population has recorded more deficiency of Vitamin A, niacin, Vitamin C and folic acid among the vitamins; calcium and phosphorous deficiencies among the minerals groups. The proportion of rural population nutrients deficiency is 70, 69, 61 & 3 percent lower than the RDA of vitamins; while in minerals the RDA is 43 and 16 percent lower respectively of calcium and phosphorous.

In order to reduce the nutritional deficiencies a balanced diet should be consumed daily. The intake of green leafy vegetables alongwith fresh seasonal fruits should be augmented to reduce the proportion of vitamin A & C deficiencies. More consumption of milk, dried legumes and meat will help increase availability of calcium and iron to the population. If this is not feasible due to various economic, social and cultural reasons, food fortification methods (like iron fortification, folic acid fortification) and food supplementation (by periodic administration of pharmacologic preparations of nutrients as capsules or tablets or by injection) can be adopted which are some important alternatives available to the people because of advances in science and technology and transportation and communication network.

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